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Prescribed versus Enacted Curriculum: Analyzing Authentic Assessments Through Performance Tasks

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Prescribed versus Enacted Curriculum: Analyzing Authentic Assessments Through Performance Tasks

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By

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The University of Texas at Austin, 2014

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As the requirements for completion of a high school diploma and the standards set locally and nationally take shifts towards more rigorous coverage of science, technology, engineering and mathematics (STEM), and applicability to the work place, public school curricula must evolve. This report focuses on an urban school district in Texas in the midst of transitioning towards using (i) assessments based on use of STEM principles in "authentic" applications and (ii) product-based evaluations dubbed performance tasks. Physics instructors within the district provided their experiences in the implementation process as well as their views on the authenticity of the tasks they are urged to use. The information from the physics teachers was used as the basis for identifying areas for professional training needed to support instructors in the use of authentic assessments, whether prescribed or instructor-developed.

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Chapter 1: Introduction – Prescribed Versus Enacted Curriculum

President Barak Obama's remarks in his 2009 address to the National Academy of Science, and again in his State of the Union address in 2013, that US youth rank 25th in math and 21st in science compared to other nations in the world, an unimaginable ranking for a major world super power (Educate to Innovate, n.d.). The current rapid evolution of fields such as information technology, biotechnology and nano-technology will require students to have increasingly sophisticated skills in math, science and engineering. Significant national attention is now focused on the effectiveness of preparation of students in these fields, as well as the quality of education of their instructors to meet these needs. President Obama praised the efforts of Science, Technology, Engineering, and Mathematics, STEM, teacher preparatory programs at the college level such as the UTeach Program. Developed at the University of Texas at Austin in 1997, the UTeach Program has been replicated at over 40 universities across America, using student-centered and activity based instruction through inquiry models (UTeach, 2014). While a new generation of teachers are being prepared to use inquiry models in programs such as UTeach, for current instructors, transformation to activity-based, problem-based, and project-based instruction will rely on, professional development based on frameworks such as Understanding by Design (Wiggins & McTighe, 2005).

Implementation of these types of instructional transformations can be a challenge. This report examines a small urban Texas district encountering a change in curriculum toward more activity and project based instruction. In 2012, to incorporate technological and engineering principles into science education, this district incorporated authentic assessments through activities referred to as performance tasks. The authentic assessments in this framework are open-ended assessment tools requiring application and synthesis skills on the part of the student. Additionally, instructors allow students time for feedback, collaboration among peers, and multiple avenues for solutions, unlike other types of summative assessments, such as paper tests and projects. A performance task is a specific form of authentic assessment used to allow students to make real-world applications, employing conceptual scientific understandings and mathematical reasoning.

The district created performance tasks for all course curricula. These tasks were designed by active instructors employed within the district. These model performance tasks were used to guide all teachers in the depth of knowledge that they were expected to provide, while giving them a sample of potential student performance task products and grading rubrics. For example, the performance task entitled Lunar Landing for the unit covering acceleration in an on-level physics class, has students take on the role of representing a private space travel corporation that needs to determine how to get four loads of cargo to land safely on the moon knowing the mass of each cargo load and the maximum velocity with which it can fall without damaging the contents of the cargo container. Students are asked to determine from what height the space craft they are using should release the cargo loads and provide mathematical proof to support their reasoning. Theses performance tasks were designed by on-level physics instructors within the district from different high school campuses in the district, along with secondary science instructional coaches for each high school campus. The district adopted 14 performance tasks for the on-level physics course, assigning one task for each instructional unit, except the circular motion unit which has two performance task options. Using inquiry models of instruction during the design process, the team of on-level physics instructors and the secondary science instructional coaches designed the tasks to be introduced at the beginning of an instructional unit and to be completed by the end of the unit. Each unit is designed to take from two to three weeks to complete during a six-week grading period. These unit topics include one dimensional motion and measurement, acceleration and free fall, projectiles and relative motion, forces, circular motion and gravitation, momentum and impulse, energy, work, power, and thermodynamics, electrostatics and magnetism, circuits, waves and sound, light and mirrors, refraction and lenses, and quantum phenomena. During district-level summer training in 2013, the secondary science instructional coaches introduced the new unit plans and performance tasks to all on-level physics instructors employed by the district, including a sample of expected products and a grading rubric for each performance task. On-level physics instructors were informed that the tasks served as models for assessing higher level thinking skills of application and synthesis of conceptual knowledge to a real-world task.

With the adoption of a new curriculum, opposition and hesitation about the next big idea is expected. Individuals within a system, such as a school district, adopt changes at different points due to various types of influences connected to the system. (Rogers, 1995) For teachers, factors influencing their levels of adoption include years of teaching experience and teaching styles. The question at –hand is to what extent are teachers utilizing the performance tasks, and what changes can and should be made to meet teacher needs as they aim to meet student needs.

Chapter 2: Literature Review – A History of Curriculum Development

Since the establishment of the United States, public education curricula have been continually reformed, with a particular focus on science, technology, engineering, and mathematics reforms beginning in the second half of the twentieth century. In the 1950s, growing tensions between the US and the Soviet Union, including over the arms race, gave rise to a national reformation of not only the public education system, but more specifically towards science education. Subsequently, the coming Cold War required educating America's youth with the necessary knowledge and skills to compete with their counterparts in Russia. Changes were made to attract qualified persons to teach such as increasing teacher salaries. Additionally, federal funding became available through nationally recognized organizations such as the National Science Foundation, to promote reform of instructional methods (Rudolph, 2002).

As urged by educational contributors like Ralph Tyler, research-based arguments towards student-centered instruction arose to address the necessity for alignment between academic curricula and vocational needs (Niebling, 2012). In Tyler's publication regarding curriculum development, he emphasized objectives being created "by identifying those that stand high in terms of values stated or implied in the school's philosophy," bringing the power of assigning standards to districts, and even the individual schools (Tyler, 1949).

Continued federal funding was made available to public school systems, pending their adoption of national standards for core curriculum, creating a basis for uniformity of instructional goals. Following the institution of national standards are national assessments, referred to as standardized tests, such as the American College Testing (ACT) in the 1950s (Fletcher, 2009). During the 1980s, the Third International Mathematics and Science Study, TIMSS, completed studies, revealing specific differences in the "content, depth and breadth of instruction, and the relationship of instruction to student achievement," students' performance on standardized tests differed across the country (McKnight, Crosswhite, Dossey, Kifer, Swafford, Travers, & Cooney, 1987). As states maintain their own versions of standardized testing, in Texas, the standardized test given for grades 3 to 11 began as the Texas Educational Assessment of Minimum Skills (TEAMS) In 1996, the National Science Education Standards, were developed for all science subjects to maintain a level of expectation for instruction. (National Science Education Standards, 2014) The TEAMS later became the Texas Assessment of Academic Skills until 2002, followed by the Texas Assessment of Knowledge and Skills (TAKS) from 2003 to 2012. As the exams changed, the number of subject areas covered increased from mathematics, reading, and science to include history, coupled with higher level of questioning (History of Testing in Texas, 2007).

In 2010 Texas legislatures re-assessed the then state standardized exam, TAKS, finding the exam did not meet the requirements of "postsecondary readiness" set by the Texas Higher Education Coordinating Board (THECB) for high school students to be aligned with expectations for college-level coursework. For the 2011-2012 school year, a new standardized exam required for high school graduation in Texas, called the State of Texas Assessment of Academic Readiness End of Course Exam (STAAR/EOC), was adopted compelling school districts across the state to assess the efficacy of their curriculum at the time (State of Texas Assessment of Academic Readiness, 2014). Analysis and application skills were not being met through the recall-type of questions student were expected to master under TAKS. To aid educators, the Texas Essential Knowledge and Skills, TEKS, were re-evaluated to ensure unified goals for all Texas schools at respective grade levels for every course (Texas Essential Knowledge and Skills, 2014).

Designing Curriculum for Higher Order Thinking

Because of standardized test such as TAKS, districts bear the responsibility of narrowing the focus of instruction on specific measurable tasks and behaviors by students, yet overarching, higher order thinking requirements are set by national and/or state objectives,. The district examined in this work utilized an Understanding by Design framework to introduce higher order thinking into the science curriculum beginning in the 2012-2013 school year. As designed by Wiggins and McTighe the Understanding by Design framework (Figure 1) uses three stages, which are referred to as backward design. Educators begin with (1) identifying the desired results, which includes analyzing what concepts students should learn and what they should be able to do; (2) determining the acceptable forms of evidence of learning; and (3) developing an aligned learning experience (Wiggins & McTighe, 2005). The stages are referred to as unit planning, clearly laying out the goals, assessment, and the "learning plan". This process pushes educators to specify their expectations while allowing differentiation in the assessment process.

In the district examined in this report, instructors from every campus within the district volunteered to interpret the TEKS based on their prior knowledge of teaching each course, coupled with the skills students will need in their post high school careers. Beginning with established goals, the Understanding by Design template provides instructors with the depth of instruction they are expected to accomplish. The understandings and essential questions highlight the main ideas students must gain as long-lasting knowledge and/or skills. In stage two, the modes through which the understandings and essential questions are assessed are provided. This includes the performance task as well as other forms of assessment, such as quizzes, daily assignments, and paper tests. Lastly, the learning plan maps how students are introduced to concepts and continuously given the opportunity to demonstrate their understanding. For the physics curriculum, each of the 13 units were outlined using the unit plan template, designed by experienced instructors within the district. Figure 2 shows the unit plan for the Lunar Landing performance task, described earlier in this report.

Figure 1 – Unit Plan Template

<table>
<tr><th colspan="2">Stage 1- Desired Results</th></tr>
<tr><td colspan="2">Established Goals:
What relevant goals (e.g.) content standards, course, or program objectives, learning outcomes) will this design address?</td></tr>
<tr><td>Understandings
Students will understand that…
What are the big ideas?
What specific understandings about them are desired?
What misunderstandings are predictable?</td><td>Essential Questions
What provocative questions will foster inquiry, understanding, and transfer of learning?</td></tr>
<tr><td>Students will know…
What key knowledge and skills will students acquire as a result as this unit?
What should they eventually be able to do as a result of such knowledge and skills?</td><td>Students will be able to…</td></tr>
<tr><th colspan="2">Stage 2 – Assessment Evidence</th></tr>
<tr><td>Performance Tasks
Through what authentic performance tasks will students demonstrate the desired understandings?
By what criteria will performance of understanding be judged?</td><td>Other Evidence
Through what other evidence (e.g. quizzes, tests, academic prompts, observations, homework, and journals) will students demonstrate achievement of the desired results?
How will students reflect upon and self-assess their learning?</td></tr>
<tr><th colspan="2">Stage 3 – Learning Plan</th></tr>
<tr><td colspan="2">Learning Activities
What learning experiences and instruction will enable students to achieve the desired results? How will the design

W = Help the students know Where the unit is going and What is expected? Help the teacher know where the students are coming from (prior knowledge, interests)?
H = Hook all students and Hold the interest?
E = Equip students, helps them Experience the key ideas and Explore the issues?
R = Provide opportunities to Rethink and Revise their understandings and work?
E = Allow students to Evaluate their work and its implications?
T = Be Tailored (personalized) to the different needs, interests, and abilities of learners?
O = Be Organized to maximize initial and sustained engagement as well as effective learning?</td></tr>
</table>

Figure 2 – Lunar Landing Performance Task

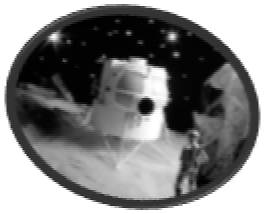
Lunar Landing

Introduction

A private space travel corporation has requested your assistance to safely deliver several types of cargo to the moon's surface.

Below are the details about each specific cargo.

	Mass	Max Velocity
Cargo A	600 Kg	10 m/s
Cargo B	2000 lbs	45 m/s
Cargo C	1/2 ton	72 m/s
Cargo D	23 g	17 m/s



Data

Create a data table and calculate the height that each cargo can be dropped based off the maximum velocity it can withstand.

Data Table 1: Cargo Release Heights

Cargo	Max velocity (m/s)	Acceleration (m/s^2)	Maximum Height (m)
A			
B			
C			
D			

Analysis

Select one cargo and diagram its position each second from release to impact. At each second, include the time, velocity, and displacement from previous second.

Data Table 2 For Selected Cargo

Time (s)	Displacement (m)	Velocity (m/s)	Acceleration (m/s^2)	Position (m)
0				
1				
2				
3				
4				

Optional Extension

- Graph the acceleration vs. time, velocity vs. time, displacement vs. time, etc. for each of the cargo.
- Use different planets and their acceleration rates due to gravity.

Revised 8/2013

Evidences of Learning - Assessment

Assessments have multiple uses for proper instruction ranging from gauging the performance of students to acting as an influence on the teacher's instruction (Bell & Cowie, 2000). The typical use of assessment is as an accountability tool for educators. In a sensible attempt to ensure curriculum goals of knowledge and skills are met, traditionally standardized multiple choice exams, such as the Stanford 9 and the TAKS exams in Texas, have been implemented. These types of tools tend toward recall skills of memory as opposed to constructive skills of learners using existing knowledge to derive useful actions (Berlak, 1992).

McTighe and Wiggins mention multiple types of assessments are needed for effective instruction, with formative assessment specifically occurring throughout instruction (Wiggins & McTighe, 2005). Key characteristics of formative assessment are responsiveness, the source of information and evidence, implicit communication, the use of professional experience, teacher-student involvement, and relativity. It serves as an informal indicator of student learning, as well as serving as an indicator of where the instructor needs to correct misconceptions, elaborate for further understanding, or re-teach a concept (Bell & Cowie, 1997). Instructors adjust their instruction based on student response to well-structured questioning, allowing them to provide feedback to individual students to improve their learning (Bell and Cowie, 2000).

Most research points to the use of varying forms of assessment as learning styles differ for individual students. The use of performance-driven investigations grants instructors the ability to differentiate among their student population (Johnson, 1989).

Performance-based assessment tools can be used to solidify transfer of understanding, and when coupled with an authentic experience (Erickson & Meyer, 1998), students gain a context to which they can apply their conceptual knowledge (Tamir, 1998).

Setting itself apart from summative assessment, which tends to occur when assigning a quantitative value to student knowledge, formative assessment allows the instructor to gain insight into a student's understanding and provide immediate feedback to students to correct misconceptions and erroneous applications (Bell, 1995). Although both forms of assessment lead to student learning, summative assessment is typically viewed as a culminating tool, not lending itself to a direct student-teacher or student-student interaction. During this interaction between student and instructor, certainly instructors can gauge student understanding, and then in turn develop new ways to deepen apt use and transfer of knowledge. The interactive nature of communication in formative assessment yields reliability in instruction that cannot be matched by corrections made on a test or quiz (Black & William, 2005).

As education shifts from the desire of students demonstrating understanding of knowledge to the transfer and application of concepts as seen in the real-world, assessment should rise to meet comparable instruction (Biggs, 1996). The typical standardized test may not accomplish this feat itself, opening the possibility for other forms of assessment, whether summative or formative. A potential testing bias exists, as many teachers tend towards teaching to their tests (Prodromou, 1995). These alternative assessments as envisioned by Birenbaum and Dochy should grant students the ability to work continuously on their learning through reflection and collaboration with peers and instructors within their learning community (Birenbaum & Dochy, 1996). Authentic assessments were developed to curb this need, as they are intended to require learners to use their knowledge and skills to complete a task that does or could exist in the professional realm (Gulikers, Bastiaens & Kirschner, 2004).

Authentic assessment will involve students completing a task that mirrors expectations and complexities from real-world experiences that apply the concepts they are expected to learn (Gielen et al., 2003). Assessments prove of little use to students if they are not granted the opportunity to reflect on their performance and address any misconceptions they may have. That is not to say that summative assessments are not necessary as a cumulative indicator of what was retained factually and transferred by each student. Authenticity is relative to the use of the curricular concepts and how they apply to the real world, which should be determined prior to designing an appropriate task (Nicaise, Gibney & Crane, 2000). A select group of the district instructors and administrators designed performance tasks to meet these characteristics of authentic assessment tools with the 2013-2014 school year marking the first installation of the performance tasks in the district curriculum. Figure 2 shows the performance task called *Lunar Landing*, used for the unit covering acceleration. As students analyze this task, they are guided to identify key terms such as maximum velocity, maximum height, and position and further connect the concepts of these terms with one another. The included extension spirals graphical analysis skills obtained by students in the previous unit of one dimensional motion, connecting relationships between position versus time and velocity versus time graphs with an acceleration versus time graph.

Instructional Model: Unit Planning with Performance Assessment

Performance tasks were used with the purpose of allowing authentic opportunities where students apply the concepts and skills taught in class to a real-world problem. Ideally, authentic assessments are introduced as inquiry activities to students, structured similarly to project-based instruction (Wiggins & McTighe, 2005). The district examined in this work utilized the 5E model. The 5E model is designed to promote an inquiry approach towards instruction using five stages: an engagement, an exploration, an explanation, an elaboration, and an evaluation. Students are expected to be *engaged* into the topic by the use of probing ideas or demonstrations to cause student questioning. Students then try to *explain* the phenomenon based on their knowledge, but are still left in an incomplete stance urging further *exploration* of the topic through making observations of phenomena. Once they formally explore the scenario, students are expected to provide an *explanation* of their findings accompanied by a further *elaboration* of the concept at hand. The *elaboration* allows students to apply their findings to a new and similar situation. Finally, students complete a suitable *evaluation*, whether formative or summative (Lawson, 2002). Although the 5E model is ideal, all modes of instruction are utilized and allowed in the district. The unit plans provide instructors with a variety of activities and resources they may use during instruction, but do not limit them to only those listed on the unit plan. The performance tasks were designed to serve as evaluations to each unit as they are types of authentic assessments. *Lunar Landing* requires students to know how the maximum height of an object relates to the maximum speed the object can reach before hitting the ground. Taking into account the acceleration due to gravity on the moon, this performance task assesses whether students understand that objects accelerate at a fixed value during free fall, and make the proper adjustments to determine the height at which the cargo should be dropped to remain within the parameters provided.

Prescribed and Enacted Curriculum

Within the concept of curriculum exists the notions of “prescribed” and “enacted” curriculum. The term “prescribed curriculum” describes the curriculum designed to be implemented within a given populace such as a school district. The “enacted curriculum” describes the actual tasks, lessons, and methods carried out by the instructor within the classroom. Enacted curriculum is “bidirectional” (Remillard & Heck, 2010) in that it involves teacher-student interaction, and oftentimes student-student interaction (Doll, Jr. 1993). The prescribed curriculum, sometimes referred to as intended curriculum, generally holds the property of ambiguity to allow flexibility during instruction. In Texas, the standards required for primary and secondary schools are called the Texas Essential Knowledge and Skills, TEKS, which provides process skills and content expectations for all grade levels. The subject areas covered by the TEKS are career development, career and technical education, economics, English language arts and reading, fine arts, health education, languages other than English, mathematics, physical education, science, social studies, Spanish language, and technology application (Texas Education Agency, 2011).

Each of the subject areas have a variety of subtopics within them, which also vary by grade level. Within the broad subject area, schools are given the liberty to have special courses, such as electives, that do not count as required core curriculum (English, mathematics, science, and social studies) but which students may take as an option, such as wood shop (career and technical education) and robotics (technology application). Although the actual standards are the same for all teachers within a subject and grade level, another layer of flexibility lies within the specific objectives for a subject. Every school district within the state then has the task of addressing the specific goals they intend to address, which are still in keeping with the state standards. Generally, a scope and sequence, detailing the topics and the time spent on those topics, are provided to every teacher of a particular course in the district. Within the classroom, the enacted curriculum possesses another layer of flexibility, allowing the instructor to make adjustments to the scope and sequence or individual assignments as they deem necessary.

Narrowing the Focus

The district sampled caters to an urban city in Texas, which covers about 181 square miles in east Texas. The district maintains ten high schools, 13 junior high schools, 37 elementary schools, with varying demographics, consisting of over 60,000 students and nearly 15,000 administrators, teachers, and other staff members. The ethnic demographics of students include 43% White/Caucasian, 34% Hispanic, 9% African-American, 11% Asian, and less than 0.3% Native American. Economically, over 30% of the students are qualified as low income, with nearly 34% as at-risk. About 14% of the students are Limited English Proficient (LEP).

Instructors within the district access the prescribed curriculum through a web-based, comprehensive application that houses "objective groups, clarifiers (sample assessments, rubrics, etc.), resources, essential questions, essential vocabulary, structures, strategies, TEKS correlations, TAKS correlations, instructional documents, technology tools, and district lessons." The intention behind using a highly accessible database for curricula is to provide teachers an outlet with which to "plan lessons online and share them with others on their campus and across the district," promoting vertical and horizontal alignment through "non-negotiable curricular objectives within each six weeks while allowing teacher flexibility in lesson design" (quotation from district documents.).

The District Curriculum

The curriculum for the district is determined by a designated committee aimed at addressing the objectives outlined in the TEKS, placed in a chronological order. The district uses a framework of the TEKS to develop curriculum using the vertical team approach, which enables for the alignment of standards from elementary through high school. The goal of this process is for linear sequential learning to occur and concepts to continually build off of one another. The objectives provided by the district are mandatory and must be established within each lesson. The district, however, does not provide a prescribed means for the implementation of these standards. The district does provide teachers with a clear guideline of what must be accomplished- the means to get there, however, are decided by the subject team of teachers at each school. According to the district curriculum, the school year is separated into six grading cycles consisting of approximately six weeks each. The Physics curriculum is separated into 13 units: one dimensional motion and measurement, acceleration and free fall, projectiles and relative motion, forces, circular motion and gravitation, momentum and impulse, energy, work, power, and thermodynamics, electrostatics and magnetism, circuits, waves and sound, light and mirrors, refraction and lenses, and quantum phenomena. The unit plans serve as a guide to instructors, maintaining the obligatory results in stage one. Stages two and three serve as suggestions, as there are multiple methods of assessment and teaching styles. The performance tasks used for each unit are modeled after a real-world application of the understandings and essential questions.

Another requirement provided by the district is the conduction of Professional Learning Communities (PLCs). These are mandatory weekly team meetings held in order to provide teachers with the opportunity to collaborate on lesson plans and student learning goals. The purpose of PLCs is to ensure that while the district does not prescribe specific methods for teaching the required objectives, the instructors within a team on any campus in the district must execute the lessons unvaryingly, utilize the same materials, and have common assessments. Additionally, the district assigns an instructional coach, shared between three schools, who conducts mandatory professional developments for all teachers that showcase methods for incorporating technology within lessons.

Chapter 3: Methods

Three aspects of the curriculum needed to be investigated are (1) the developmental process, (2) implementation of the curriculum, and (3) the authenticity of the products of each of the 14 performance tasks developed for instructor use, one for each of the 12 units and two for circular motion and gravitation. In order to determine the authenticity of the tasks employed by the district, the instructors who will have to utilize and facilitate them were queried. Physics instructors within the district were targeted. They completed a questionnaire through Google Forms, inclusive of a consent form. The questionnaire allowed the Physics instructors to discuss the developmental process, the implementation of, and the authenticity of the products of each of the 14 performance tasks developed for their use. The questions given to instructors can be found in Figure 3. These questions used were developed to provide instructors the opportunity to reflect on their adoption and implementation of the prescribed performance tasks. They were asked whether they used each task and if they did not use the task, to provide their justification of why they chose not to use the prescribed tasks, and a description of the assessment they used to replace the task. Additionally, instructors were asked how they were introduced to the unit plans and prescribed performance tasks. Their experience with district administration may relate their level acceptance of the performance tasks.

Aside from the instructor’s experience with the tasks themselves, demographic information was required from each of the instructors. To maintain anonymity, the demographic information did not include the instructor’s campus name; however, the educational background of the physics instructors was considered to gauge whether authentic assessment was of interest to the instructor prior to the district's implementation. They were asked to describe their instructional style to determine potential correlations in how they introduced the performance task to their students. Instructional style may also correlate with type of tasks used to replace performance tasks when teachers opted not to use the modeled performance tasks. Instructors with more teaching experience may tend to use their own assessments instead of a new assessment they have not used. For this reason, years of teaching experience may relate to whether a teacher supports the adoption of the performance tasks.

Figure 3 –Physics Instructor Questionnaire

Mode of Answer: [M] = multi option [P] = Paragraph
[R] = Rate/Scale [T] = Text response

Demographic information:

1. Which grade level do you currently teach? [M]
2. How many years have you been a certified teacher? [T]
3. How many years have you taught in the district? [T]
4. With which gender do you identify yourself? [M]
5. Which of the following represents you current age range (20-30, 31-40, 41-50, 51-60, or 60 +) [M]
6. What is your teaching certification type? [M]
7. College Major [M]
8. In which science subjects do you currently teach? [M]

Instructional Data:

9. Which of the following best describes your current teaching style (Direct, Inquiry, Modeling, or Project-Based) [R]
10. Who introduced the concept of unit plans and performance tasks to you/ your team? [M]
11. Were you utilized in drafting the performance tasks in the district? [M]
12. Which of the following performance tasks did you use in your classroom? [M]
13. An authentic assessment is defined as a meaningful task which resembles a real-world experience. Which performance tasks were authentic assessments? [M]
14. If you did not use a performance task, did you use an equivalent assessment? Explain. [T]
15. If you did not use the prescribed task and created your own, did you share it with an administrator (IC, DC, principal)? [M]
16. At what point within a unit did you introduce the performance task? [M]
17. In general, how long were students allowed to complete the performance tasks? [M]
18. What changes would you like to see made for any performance task or unit plan? [T]
19. What additional comments would you like to make regarding performance tasks or unit plans? [P]
20. In the event that I have a follow-up question regarding your response, may I contact you via e-mail? If yes, please provide your e-mail address. [T]

Chapter 4: Results and Discussion

Twelve physics instructors completed the questionnaire. Upon completion of the questionnaire through Google Forms, each instructor was issued a letter code from A to L. Teaching styles were also issued a numerical value of 1 to 4, where 1 represents direct instruction, 2 represents modeling, 3 represents inquiry-based, and 4 represents project-based instruction; these teaching style self-assessments were used to investigate connections between tendencies towards or against using the performance tasks or assessing them as authentic forms of assessment.

The responses of the instructors were separated into groups based on the demographic information, including age range, instructional style, and years of experience. As seen on question 10 in Figure 3, instructors were asked who informed them of the change towards using performance tasks, ten of the twelve instructors indicated they were informed by a district administrator, which includes Instructional Coaches. Two instructors, identified as H and J, indicated that a colleague informed them of the change. Both instructors further indicated that the colleague who informed them was a part of the committee used to develop the tasks for the district, and that they were later informed about the transition to performance tasks by a district administrator. District officials offered trainings for instructors during summer months of 2013 to introduce, demonstrate, and provide products for each of the performance tasks, presumably with the hopes of increasing instructor cooperation through proactive support.

Figure 4 reports the extent to which teachers used the performance tasks. As reported, nearly 93% of the tasks were completed by at least one instructor. One task, “Rock Me, Galileo”, was not completed due to immediate skepticism from instructors, and was replaced with an alternative activity to address a form of circular motion, “SkyFall”. “Sound Control” was the only task not completed by any teacher within the sample.

The average number of tasks completed per instructor was 4.8 ±1.62, with a minimum of 2 to a maximum of 7. Within this group of teachers, the maximum percentage of tasks used by any single instructor was still under 70%.

Table 1 – Performance Tasks Used By Each Instructor

		Instructor Code											
No. of Task	Name of Task	A	B	C	D	E	F	G	H	I	J	K	L
1	Katy Marathon						•	•		•			•
2	Lunar Landing		•	•	•	•		•	•	•	•	•	•
3	Just Launch It!						•	•		•		•	
4	Newton and Nye				•	•			•			•	
5	Rock Me Galileo												
6	Can you Cell It?									•			
7	Six Flags - Katy		•	•	•	•	•	•	•	•	•	•	
8	SkyFall	•				•	•		•	•	•	•	
9	It's Not Magic, It's Science		•	•				•					
10	Friendship Detector		•						•		•	•	
11	Sound Control												
12	Reflecting on Home Security												•
13	Lights, Camera, Refraction	•	•	•					•	•	•	•	
14	A Quantum Minute		•	•					•				

Table 2 – Performance Tasks Viewed As Authentic

		Instructor Code											
No. of Task	Name of Task	A	B	C	D	E	F	G	H	I	J	K	L
1	Katy Marathon						•	•		•			•
2	Lunar Landing		•			•		•	•	•	•	•	•
3	Just Launch It!							•		•		•	
4	Newton and Nye					•			•		•	•	
5	Rock Me Galileo												
6	Can you Cell It?							•		•			
7	Six Flags - Katy		•					•	•	•	•	•	
8	SkyFall								•	•	•		
9	It's Not Magic, It's Science		•	•				•					
10	Friendship Detector									•	•		
11	Sound Control									•			
12	Reflecting on Home Security							•		•			•
13	Lights, Camera, Refraction	•	•	•				•	•	•	•		•
14	A Quantum Minute												•

Table 3 – Teaching Styles and Assessment Replacements

Style Code	Teaching style	Number of Instructors	Instructors Using Different tasks	Authentic Replacements
1	Direct	2	1	0
2	Modeling	5	5	4*
3	Inquiry	4	4	3*
4	Project-Based	1	1	0*

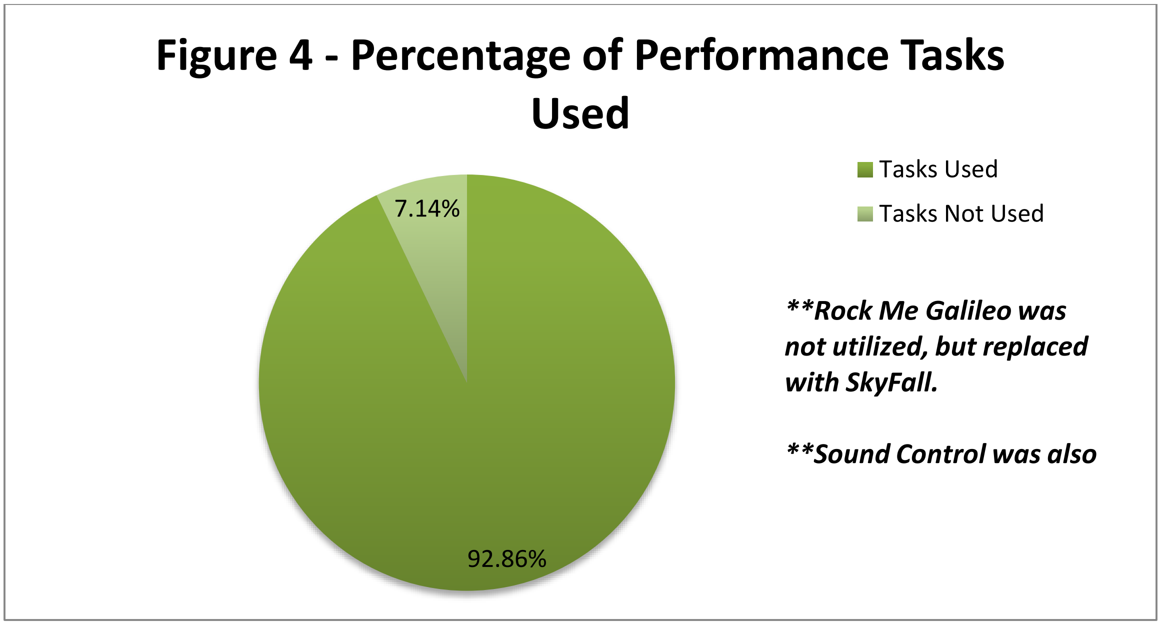


Figure 4 - Percentage of Performance Tasks Used
Tasks Used
Tasks Not Used
7.14%
92.86%
**Rock Me Galileo was not utilized, but replaced with SkyFall.
**Sound Control was also

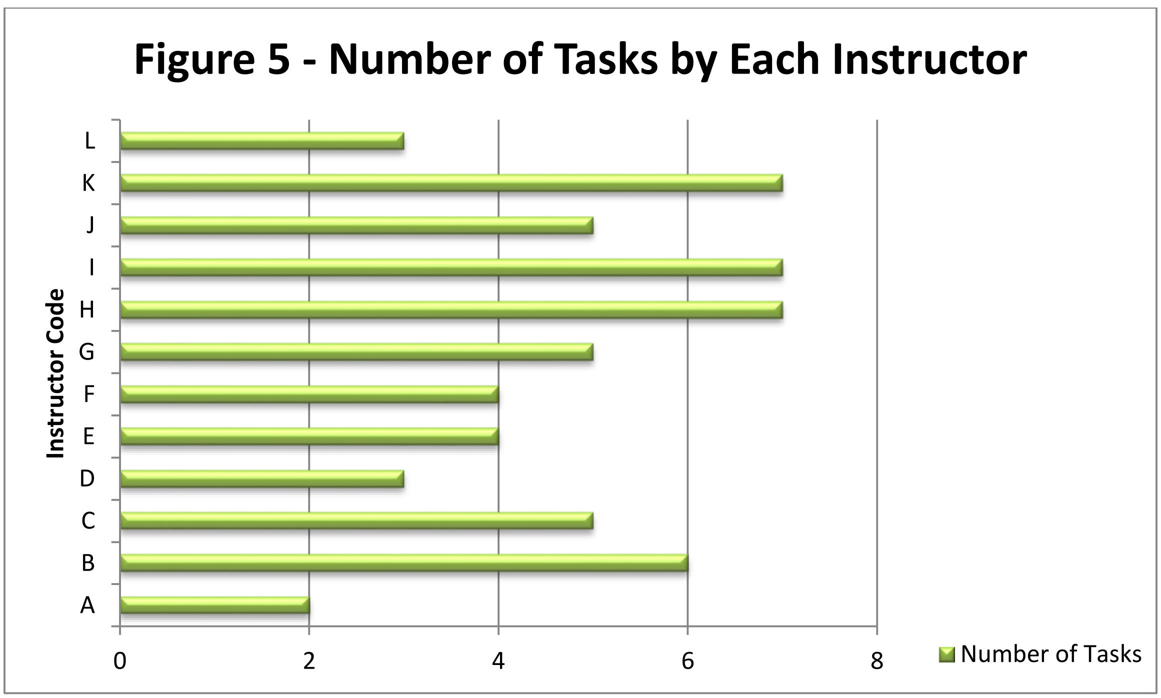


Figure 5 - Number of Tasks by Each Instructor
Instructor Code
L
K
J
I
H
G
F
E
D
C
B
A
0
2
4
6
8
Number of Tasks

Figure 6 – Performance Tasks Used and Accepted as Authentic

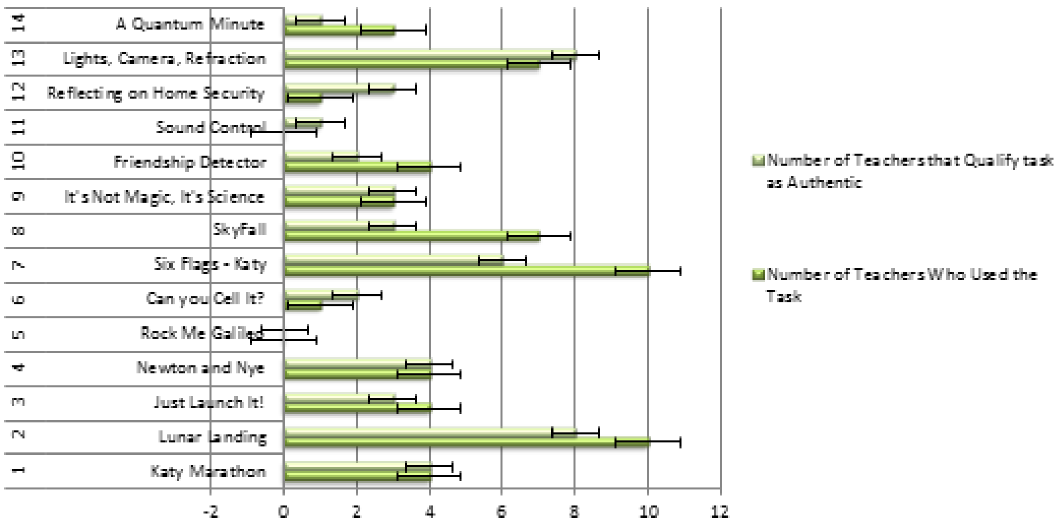
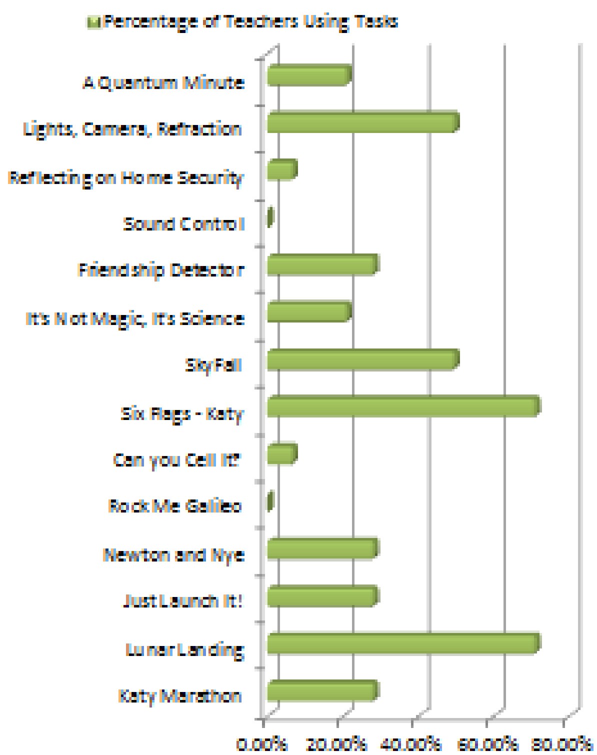


Figure 7 – Percentage of Physics Teachers Using Tasks



As shown in Figure 5, certain tasks tend to be used more than others. The majority of teachers, about 80%, opted to use “Lunar Landing”, designed towards demonstrating the quantity of acceleration when trying to land cargo upon the moon, and “Six Flags – Katy,” allowing students to design a roller coaster based on the Law of Conservation of Energy. The tasks deemed authentic assessments by each instructor are shown in Table 2. Revisiting the definition provided by Gielen and colleagues, these assessments should require students to “[complete] a task that mirrors expectations and complexities from real-world experiences which apply the concepts they are expected to learn”, defined in this instance as the objectives from the TEKS (Gielen et al., 2003). Some tasks were identified as authentic by more instructors than those who reported completing the tasks with their students. These instructors were then contacted via e-mail to explain their decision. Instructor K explained that “they are all authentic…As for real world we still need some tweaking to make them better”.

To determine whether the tasks earned an authentic rating by the instructors were more frequently used among the instructors in the sample, the fraction of instructors who viewed them as authentic was compared to those who completed the tasks in terms of percentage. Figure 5 shows there four tasks that had more than 70% use among teachers viewing the tasks are authentic. “Katy Marathon” with 100%, “Lunar Landing” with 80%, “Just Launch It!” with 75%, and “It’s Not Magic, It’s Science” with 100%, and “Lights, Camera, Refraction” with 75%. Instructor D did not view any of the performance tasks as authentic, but rather “worksheet type of [assignments]”. The three tasks getting high ratings as authentic – “Can You Cell It?”, “Sound Control”, and

“Reflecting on Home Security” had the support of instructors that did not complete the tasks.

Revisiting the notion of instructors only using an average of 37% of the tasks prescribed, Table 3 provides data on whether instructors are replacing the tasks with equivalent forms of assessment. Notably, this information was correlated with instructional style. Of the two instructors who identified themselves as direct teachers, one opted to replace the performance tasks not used with multiple choice tests. The other chose not to assess the unit at all. Also for the performance tasks they used, the direct instruction teachers tended to provide them to students at the end of the corresponding unit, allowing students 2 – 3 days to complete the assignment. The instructors that identify with modeling, inquiry, and project-based instruction, in general replaced the tasks they did not complete with various types of projects, listing a wide range of reasons for doing so. Instructor B decided to use a different task than the “Friendship Detector” due to a lack of materials for students to complete the assignment. Three instructors (H, J, and K) who teach on the same team, decided not to replace “Reflecting on Home Security” with an equivalent assignment, but with a quiz, citing a lack of instructional time due to state testing during that particular unit. They account for each of the instructors with modeling, inquiry, and project-based teaching styles that did not replace all of their missed performance tasks with an equivalent authentic assessment tool. For this group of teachers, the mode of instruction did not appear to be directly linked to how the performance tasks were introduced to students. For some units they were used as instructional and assessment tools, while for others they were only used as assessment tools towards the end of the unit. The determining factor behind these decisions for at least one team of teachers (H, J and K) was linked to a team collaboration to accommodate to all teaching styles of members of their teams.

Chapter 5: Conclusion

The responses of the Physics instructor sample for this study show a majority of the instructors are interested in providing authentic assessment tools, but not necessarily in the form of the performance tasks provided them by the district curriculum writers. Additionally, some instructors introduced the performance tasks in terms of the needs of their team as opposed to their individual teaching styles, with exception of the direct instruction teachers. Without knowing the team dynamics every teacher had to encounter, one can only speculate whether the differences among each teacher's instructional style resulted in a compromise to meet the desires of the district's overarching requirements.

Changes to be made in the methods of data collection include the timing of the questionnaire, and the depth of the questioning. Instead of providing this questionnaire to instructors at the end of the school year, it would be beneficial to issue a questionnaire at the end of each unit to better determine the mindset of the teachers and their professional learning communities while maintaining accuracy and integrity among teacher responses. Furthermore, the depth of the questions being asked should address the dynamics of each instructional team to possibly uncover how common assessments may affect the authenticity of or the likelihood of use of each performance task.

As is commonly found in education, the only way to know the result is by first completing the task at hand. The district administrators should view this study as an opportunity for growth and further collaboration between its educational professionals. The low ratings of support from instructors on adopting the performance tasks suggests district officials need to revisit the authenticity of the tasks teachers identified as not being authentic. Based on the relationship between various instructional styles and the likelihood of using authentic assessments, the district should create professional developments centered on how to incorporate the performance tasks into their instruction. The performance tasks were introduced to instructors by the instructional coaches for the district. The instructional coaches completed the tasks to create grading rubrics and a sample of student work for each task. Although the student samples and grading rubrics provide instructors with some level of guidance, they do not support instructors on the implementation of the performance tasks. Since the twelve instructors who completed the questionnaire identified with one of the four instructional styles, the district must demonstrate how instructors can execute introducing and guiding students through the performance tasks. Instructors often facilitate the district-level trainings for peers to demonstrate how they use various forms of technology in their classrooms. Volunteering instructors who use different forms of instructional styles can demonstrate to other instructors how they organize the learning activities from the unit plan to prepare students to complete the performance tasks. They should also allow instructors within the training sessions to personalize their lesson plans using the learning activities from the presenting instructors to serve as the foundation for their lesson plans. This support should provide all physics instructors within the district more confidence to try the performance tasks within their own classrooms. Instructional coaches should also provide support to instructors, allowing instructors to provide structured feedback on their experiences with using the performance tasks at the end of each unit, or six-week grading period. The instructional coaches can then make the necessary alterations or suggestions to other instructors throughout the district to help them better instruction.

Chapter 6: Applications to Practice

The partnership between concepts in physics and engineering design is vital to success for students who desire to enter STEM fields. As curriculum writers revisit the first year attempts of performance tasks as authentic assessments, the data gathered from the questionnaire issued provide a basis to develop more authentic opportunities for students to apply the concepts they learn to real-world problems. A particular habit of mind from UTeach Engineering to be incorporated for physics students in the district is the concept of redesign. Accomplishing a desired product does not occur without a reevaluation process. In completing the prescribed performance tasks, students encounter opportunities to develop a variety of answers, all of which can be correct (UTeachEngineering.org, 2014).

Reflection and making changes to improve production are features of the design process that are applicable to all areas of study. Physics teachers completing the questionnaire were not allowed to complete the questionnaire until the end of the academic school year. The lapse of time between completing the tasks and reflecting on their experiences may hinder the modification process to improve the tasks for future instruction.

Physics curriculum melds comfortably with engineering education. Coupled with the objectives of UTeach Engineering, students can encounter real-world experiences that show them what engineering entails, and how physics can play a role in various types of product development (UTeachEngineering.org, 2014).

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